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DIAMOND BLADE HAVING RIM TYPE CUTTING TIP FOR USE IN  
GRINDING OR CUTTING APPARATUS

BACKGROUND OF THE INVENTION

5 The present invention relates to a diamond blade  
for use in apparatus such as a cutting saw machine for  
grinding or cutting crushable materials such as brick,  
concrete, granite, marble, etc., and more particularly to  
a diamond blade having rim type cutting tip in which at  
10 the rotation direction of the blade to form microscopic  
linear cutting grooves to cause portions of the crushable  
materials between the cutting grooves to be crushed in  
chips of relative large size by non-diamond portion of  
the cutting tip during cutting operation and thereby to  
15 enhance cutting ability of the blade and to prevent  
crushed chips dispersing easily in the air and giving rise  
to the bad effects to user's health and the contamination  
of environment.

20 A conventional diamond blade 1 for use in apparatus  
for cutting crushable materials such as cutting saw  
machine comprises steel wheel body 2 connected with a  
shaft of electric motor, and rim type cutting tip 3  
disposed circumferentially and fixedly on the steel wheel  
body 2, as shown in FIG. 1. Rim type cutting tip 3 is  
25 fabricated by mixing particles of diamond and grinding  
materials, particles of metals composing of cobalt,  
nickel, bronze, copper, etc., and particles of resin or  
ceramic and forming a rim of given shape out of the mixed  
particles by plastic working including press work.

30 Thus, diamond particles 4 are randomly distributed in

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the inside and surfaces of rim type cutting tip 3 as shown in FIG. 3.

In the blade 1, upper surface of rim type cutting tip 3 contacts with corresponding surface portion of crushable materials 18 to be cut and grinds it to form cutting slot 16 in crushable materials during cutting operation as shown in FIG.3.

Minute chips produced by cutting operation of rim type cutting tip 3 are gathered in cutting slot 16 and then discharged from there to outside by the rotation of rim type cutting tip 3.

However, since the blade 1, i.e., upper surface of rim type cutting tip 3 has same shape and material composition on the whole, both edges 15 of upper surface contacting with side wall and bottom of cutting slot 16 formed in crushable materials 18 during cutting operation are defaced faster than center 17 thereof contacting only with bottom of cutting slot 16 of crushable materials 18.

Accordingly, the contacting area between upper surface of rim type cutting tip 3 and crushable materials 18 to be cut is enlarged to increase resistance of crushable materials 18 and thereby be able to induce poor cutting and decrease cutting ability and life of blade 1.

Further, since size of chips produced during cutting operation is very minute, these chips are easy to remain in cutting slot 16 of crushable materials 18 to prevent upper surface of rim type cutting tip 3 grinding bottom of cutting slot 16 and thereby decrease cutting ability. Also, in case of those minute chips discharged from cutting slot 16 are dispersed in the air, it gave rise

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to the bad effects to user's health and the contamination of environment.

To improve these problem, there has been proposed a diamond blade 11 that a plurality of depressed portions 19 are at given intervals formed in inner and outer surfaces of rim type cutting tip 13, as shown in FIG.2.

By virtue of this blade, discharging of minute chips remaining in cutting slot of crushable materials causing rim type cutting tip to be defaced during cutting operation has been improved, but defacement of both edges of upper surface to induce poor cutting and decrease cutting ability and life of blade, producing very minute chips to decrease cutting ability, and dispersing produced minute chips in the air to give rise to the bad effects to user's health and the contamination of environment are still remained in problems to solve.

#### SUMMARY OF THE INVENTION

It is an object of the present invention to provide a diamond blade for use in apparatus such as a cutting saw machine for cutting crushable materials such as brick, concrete, granite, marble, etc., having rim type cutting tip in which at least two diamond layers are longitudinally disposed along the rotation direction of the blade to form microscopic cutting grooves in the crushable materials during cutting operation and thereby to cause portion of crushable materials between the cutting grooves to be easily crushed by non-diamond portion of the rim type cutting tip to enhance cutting ability of the blade.

It is another object of the present invention to

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provide a diamond blade for use in apparatus such as cutting saw machine having a structure which rim type cutting tip is able to produce cutting chips with relative large size during cutting operation so that those chips are easily discharged outside with reducing the friction with cutting tip of blade, thereby to increase cutting ability and to prevent those chips dispersing in the air and giving rise to the bad effects to user's health and the contamination of environment.

It is the other object of the present invention to provide a diamond blade for use in apparatus such as cutting saw machine having rim type cutting tip which diamond particles in diamond layer thereof are distributed in a given pattern to reduce the amount of diamond particles used and thereby reduce the manufacturing cost of blade.

To accomplish these objects, a diamond blade for use in apparatus for grinding or cutting crushable materials according to the present invention comprises a wheel body connected with a shaft of electric motor, and rim type cutting tip for grinding or cutting crushable materials disposed on the circumference of wheel body and composed of at least two diamond layers longitudinally disposed parallel with the rotation direction of the blade in which diamond particles are included, and non-diamond portion disposed between the diamond layers in which diamond particles are not included.

In this embodiment of the present invention, diamond layers are disposed each other at predetermined intervals perpendicular with the rotation direction of the blade.

It is desirable that diamond layers are disposed only on inner and outer surface of rim type cutting tip.

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Alternatively, diamond particles in each diamond layer of rim type cutting tip are distributed in a given pattern or arrangement such a single or double layer figure with grid shaped spots.

5 Also, in the non-diamond portion of rim type cutting tip, diamond particles can be distributed in the density lower than that of diamond layers.

10 In the other embodiment of the present invention, a diamond blade for use in apparatus for grinding or cutting crushable materials comprises a wheel body connected with a shaft of electric motor, and rim type cutting tip for grinding or cutting crushable materials disposed on the circumference of wheel body and composed of non-diamond portion having a plurality of depressed portions disposed at predetermined intervals to cross each other in inner and outer surfaces of non-diamond portion, and a plurality of diamond layers longitudinally disposed parallel with the rotation direction of the blade respectively on bottom surfaces of depressed portions of non-diamond portion and inner and outer surfaces of non-diamond portion divided by depressed portions thereof.

20 In this embodiment of the present invention, it is desirable that bottom surfaces of depressed portions of non-diamond portion are positioned in the plane forming the center between inner and outer surfaces of non-diamond portion to let diamond layers disposed thereon to form one cutting line during the cutting operation of blade.

25 Also, the depth of all bottom surfaces of depressed portions of inner and outer surfaces of non-diamond portion can be set up to be less than a half of the thickness of non-diamond portion to let diamond layers disposed thereon to form at least two linear cutting line

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during the cutting operation of blade.

#### BRIEF DESCRIPTION OF THE DRAWINGS

The above objects and other advantages of the present invention will become more apparent by describing in detail preferred embodiments thereof with reference to the attached drawings in which:

FIG.1 is a front view of one conventional diamond blade for use in cutting saw machine in which diamond particles are randomly distributed in rim type cutting tip thereof;

FIG.2 is a front view of the other conventional diamond blade in which diamond particles are randomly distributed in rim type cutting tip thereof and a plurality of depressed portions are disposed in inner and outer surfaces of rim type cutting tip thereof;

FIG.3 is a partial cross-sectional view of the conventional diamond blade shown in FIG.1 to illustrate state in which rim type cutting tip thereof is operated;

FIG.4 is a perspective view of diamond blade for use in cutting saw machine according to one preferred embodiment of the present invention which two diamond layers are longitudinally disposed respectively in inner and outer surfaces of non-diamond portion of rim type cutting tip to form two microscopic linear cutting grooves in the crushable materials during cutting operation;

FIG.5 is a partial cross-sectional view of the diamond blade of the present invention taken along line A-A of FIG.4 to illustrate state which rim type diamond cutting tip is operated;

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FIG.6 is a perspective view of a diamond blade for use in cutting saw machine according to the other embodiment of the present invention in which a plurality of diamond layers are longitudinally disposed respectively on bottom surfaces of depressed portions of non-diamond portion and inner and outer surfaces of non-diamond portion and the depth of bottom surfaces of depressed portions of non-diamond portion is a half of the entire thickness of non-diamond portion;

FIG.7 is a partial cross-sectional view of the diamond blade of the present invention overlapping cross-sections taken along lines B-B and C-C of FIG.6 to illustrate state which rim type diamond cutting tip is operated;

FIG.8 is a perspective view of diamond blade of the present invention which the depth of bottom surfaces of depressed portions of non-diamond portion is less than a half of the entire thickness of non-diamond portion;

FIG.9 is a partial perspective view of diamond blade of the present invention shown in FIG.8; and

FIG.10 is a partial cross-sectional view of the diamond blade of the present invention overlapping cross-sections taken along lines E-E and F-F of FIG.9 to illustrate state which rim type diamond cutting tip is operated.

#### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

In several embodiments of this invention described below with reference to the accompanying drawings, the invention is applied to cutting saw machine.

Referring to FIG.4, there is illustrated diamond

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blade 31 having rim type cutting tip 33 according to one preferred embodiment of the present invention for use in apparatus for grinding or cutting crushable materials such as cutting saw machine.

5 Diamond blade 31 for cutting saw machine comprises wheel body 32 connected with a shaft of electric motor, and rim type cutting tip 33 for cutting or grinding crushable materials fixedly disposed circumferentially on the wheel body 32.

10 Rim type cutting tip 33 comprises two thin diamond layers 38 and 38' longitudinally disposed respectively in inner and outer surfaces thereof parallel with the rotation direction of the blade 31, and non-diamond portion 35 disposed between two diamond layers 38 and 15 38', as shown in FIG.4 and 5.

Thin diamond layers 38 and 38' are composed of particles of diamond and grinding material, particles of metals composing of cobalt, nickel, bronze, copper, etc., and particles of resin or ceramic.

20 Particles 39 of diamond in thin diamond layers 38 and 38' are randomly distributed, or in a given pattern or arrangement such a single or double layer figure with grid shaped spots to reduce the amount of diamond particles used.

25 Non-diamond portion 35 is composed of grinding materials, metals such as cobalt, nickel, bronze, copper, etc., and resin or ceramic.

Thin diamond layers 38 and 38' function to prevent edge area of upper surface of rim type cutting tip 33 defacing and to form two microscopic linear cutting grooves 37' and 37" in the crushable materials 37 during cutting operation, as shown in FIG.5. Thus, portion 40 of 30



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crushable materials 37 between two cutting grooves 37' and 37" can be easily crushed by small friction and rotation impact power of non-diamond portion 35 and thereby non-diamond portion 35 of rim type cutting tip 33 is able to produce cutting chips with relative large size during cutting operation so that those chips are easily discharged outside with reducing the friction with rim type cutting tip 33 of blade, thereby to increase cutting ability and to prevent it dispersing in the air.

In this embodiment of the present invention, it is noted that rim type cutting tip 33 can be substituted by cutting tip composed of three or four thin diamond layers longitudinally disposed therein parallel with the rotation direction of the blade respectively to form three or four microscopic linear cutting grooves in the crushable materials during cutting operation, and non-diamond portions disposed between the three or four diamond layers.

The diamond layers are each other disposed at predetermined intervals perpendicular with the rotation direction of the blade between non-diamond portions of cutting tip.

In this case, portion of crushable materials between the microscopic linear cutting grooves can be easily crushed by friction and rotation impact power smaller than that of non-diamond portion 35 of rim type cutting tip 33 having two thin diamond layers 38 and 38'.

Also, in the non-diamond portion of rim type cutting tip, diamond particles can be distributed in the density lower than that of diamond layers of rim type cutting tip.

Referring to FIG.6 and 7, there are illustrated diamond blade 41 according to the other preferred

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embodiment of the present invention for use in apparatus for cutting and drilling crushable materials such as cutting saw machine.

Diamond blade 41 for cutting saw machine comprises wheel body 42 connected with a shaft of electric motor, and rim type cutting tip 43 disposed fixedly on the circumference of wheel body Rim type cutting tip 43 has non-diamond portion 45 having a plurality of depressed portions 44 disposed at predetermined intervals to cross each other in inner and outer surfaces of non-diamond portion 45.

Rim type cutting tip 43 further includes a plurality of diamond layers 48, 48', and 48" longitudinally disposed parallel with the rotation direction of the blade 41 respectively on bottom surfaces of depressed portions 44 of non-diamond portion 45 and inner and outer divided surfaces of non-diamond portion 45 divided by depressed portions 44, as shown in FIG. 6.

Bottom surfaces of depressed portions 44 of non-diamond portion 45 are positioned on the plane forming the center between inner and outer surfaces of non-diamond portions 45 to let diamond layers 48' disposed thereon to form one microscopic linear cutting groove 47" in crushable materials 47 during the cutting operation of blade 41, as shown in FIG.7.

Thus, diamond layers 48, 48', and 48" on bottom surfaces of depressed portions 44 of non-diamond portion 45 and inner and outer surfaces of non-diamond portion 45 form three microscopic linear cutting grooves 47', 47", 47"' in crushable materials 47 to let the protruded portions 50 and 50' of crushable materials 47 between the microscopic linear cutting grooves 47, 47', 47" to be

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easily crushed by small friction and rotation impact power of non-diamond portion 45 during the cutting operation of blade 41, as shown in FIG.7.

5 Also, in the non-diamond portion 45 of rim type cutting tip 43, diamond particles can be distributed in the density lower than that of diamond layers 48, 48' and 48".

10 Alternatively, in this embodiment of the present invention, the depth of bottom surfaces of depressed portions 54 in non-diamond portion 55 can be less than a half of the entire thickness of non-diamond portion 55 to let diamond layers 58' and 58" disposed thereon to form two microscopic linear cutting grooves 57" and 57"' in crushable materials 57 during the cutting operation of blade 51, as shown in FIG.10.

15 Thus, in this case, diamond layers 58, 58', 58", and 58"' on inner and outer surfaces of non-diamond portion 55 and bottom surfaces of depressed portions 54 thereof form four microscopic linear cutting grooves 57', 57", 57"' and 57"" in crushable materials 57 to let protruded portions 60, 60' and 60" of crushable materials 57 between the cutting grooves 57', 57", 57"' and 57"" to be easily crushed by small friction and rotation impact power of non-diamond portions 55 during the cutting operation of blade 51, as shown in FIG.10.

20 Operation of diamond blades having rim type cutting tip for use in apparatus such as cutting saw machine according to embodiments of the present invention will be described, hereinafter.

30 Referring to FIG.4, there is illustrated the operation of diamond blades 31 of one embodiment of the

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present invention which two thin diamond layers 38 and 38' are longitudinally disposed respectively in inner and outer surfaces of rim type cutting tip 33. At first, when wheel body 32 is rotated by an electric motor connected with a shaft thereof to cut crushable materials 37 such as brick, concrete, granite, marble, etc., cutting tip 33 begins to grind crushable materials 37 to form a cutting slot 36 therein along a predetermined line thereon.

At this time, since thin diamond layers 38 and 38' including particles 39 of diamond are disposed in inner and outer surfaces of cutting tip 33, both edges of cutting tip 33 are defaced less than center thereof and thereby two microscopic linear cutting grooves 37' and 37'' are formed in the cutting slot 36 of crushable materials 37, as shown in FIG. 5.

By forming cutting grooves 37' and 37'', portion 40 of crushable materials 37 therebetween is weakened and easily crushed by small friction and rotation impact power of non-diamond portion 35. Thus, non-diamond portion 35 of cutting tip 33 is able to produce cutting chips with relative large size and produced chips are easily discharged outside with reducing the friction with cutting tip 33 of blade 31, thereby to increase cutting ability and to prevent produced chips dispersing in the air.

In this way, by repeating the operation of cutting tip 33 of diamond blade 31, cutting crushable materials 37 along the predetermined line thereon is completed.

Referring to FIG.7 and 10, there are illustrated the operation of diamond blades 41 and 51 of the other embodiment of the present invention.

The operation of these diamond blades 41 and 51 is same that of the diamond blade 31 of embodiment

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noted above expect that diamond layers 48, 48", and 48", or 58, 58', 58", 58"', and 58"" on inner and outer surfaces of non-diamond portion 45 or 55 and bottom surfaces of depressed portions 44 or 54 form three or four linear cutting grooves 47', 47", and 47"', or 57', 57", 57"', and 57"" in crushable materials 47 or 57.

As apparent from the foregoing description, it can be appreciated that the present invention provides a diamond blade having rim type cutting tip which at least two diamond layers are longitudinally disposed along the rotation direction of the blade to form at least two microscopic linear cutting grooves in the crushable materials during cutting operation and thereby to cause portions of crushable materials between the cutting grooves to be easily crushed by non-diamond portions of cutting tip to enhance cutting ability of the blade.

Also, the present invention provides a diamond blade having a structure which cutting tip are able to produce cutting chips with relative large size during cutting operation so that those chip are easily discharged outside with reducing the friction with cutting tip of blade, thereby to increase cutting ability and to prevent it dispersing in the air and giving rise to the bad effects to user's health and the contamination of environment.

Also, the present invention provides a diamond blade having a rim type cutting tip which diamond particles in diamond layer thereof are distributed in a given pattern to reduce the amount of diamond particles used and thereby reduce the manufacturing cost of blade.